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# Growth performance, haematological and serum biochemical parameters of rabbits fed varying dietary levels of soybean milk residue

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**Abstract**
Twenty-five cross breeds rabbits aged between 6 -7 weeks, were used in an experiment to determine the effect of feeding soybean milk residue on the performance, haematological and serum biochemical parameters of growing rabbits. The rabbits were randomly assigned to five treatments, T1, T2, T3, T4 and T5 containing 0%, 6%, 12%, 18% and 24% soybean milk residue respectively in a completely randomized design (CRD). Feed and water were offered ad libitum throughout the experimental period and the experiment lasted for 12 weeks. At the end of the feeding trial, 3 rabbits per treatment were slaughtered and blood sample from individual rabbit was collected into labeled Ethylene-diamine-tetra-acetic acid (EDTA) treated tubes for haematological analysis and the blood for serum biochemical evaluation was collected into separate tubes without anticoagulant. The results of the growth performance showed a significant increase in all the parameters measured as the inclusion level of soybean milk residue increases in the diets. Rabbits fed T5 recorded the highest final body weight (1619.28 g) while rabbits fed T1 recorded the lowest value (1410.60 g). Rabbits-fed soybean milk residue diets had a better feed conversion ratio than the control (T1). The haematological parameter measured indicated that packed cell volume (PCV), red blood cell (RBC) and haemoglobin (Hb) were significantly affected ($P<0.05$). White blood cell (WBC) count, mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were not significantly ($p>0.05$) different among treatment groups. The serum biochemistry parameters measured revealed that albumin and cholesterol were significantly different ($P<0.05$) while total protein, globulin, glucose and urea were not affected. It was therefore concluded that soybean milk residue can be included up to 24% in the diets of rabbits without adverse effects on growth performance, haematology, and serum biochemistry of rabbits.

**Keywords:** Rabbits, soybean milk residue, performance, haematology, serum biochemistry

## Introduction

The domestic rabbit (Oryctolagus cunniculus) is an important non-ruminant herbivore raised primarily for meat production. The level of animal protein production and consumption in developing countries can be significantly increased by using rabbit meat as a source of high-quality protein (Wafar *et al*., 2018) [34]. Rabbits are efficient in converting fibrous feed material into high-quality animal protein, and they possess a higher digestibility of roughage than other livestock species (Nistor *et al*., 2013) [20]. Rabbits are fed primarily on grasses and legumes in most of the developing nations of the world today due to the high cost of feeds. Feed accounts for about 70 – 80% cost of monogastric livestock production (Akinmutimi, 2006) [4]. One of the ways to reduce feed costs is the use of non-conventional feedstuff which are cheaper and readily available. Major conventional feed ingredients of energy and protein sources used in monogastric animal feeding also serve as raw material for flour milling and brewery industries as well as a source of food for humans (Adesehinwa and Ogunmodede, 2004) [3]. The increasing demand for conventional feedstuff has led to scarcity and high cost, which in turn resulted in the high cost of animal products far beyond the price range of the common consumer.

As a result, research initiatives have focused on expanding the use of farm residues and agro-industrial by-products as substitutes for conventional feedstuff (Emmanuel *et al*., 2021; Fakolade *et al*., 2018) [11, 14]. Soybean milk residue is one of the cheap and readily available sources of agro-industrial by-products. It is a by-product of soymilk, is produced in large quantities by the soy food industry and is often discarded due to its undesirable flavour. However, It has been reported to be a good source of protein in feeding livestock (Odeyinka *et al*., 2007) [21]. The utilization of soybean milk residue as a feed resource may help in reducing the pressure on conventional feedstuffs, and control environmental pollution caused because of indiscriminate discarding of waste. The study was designed to determine the effect of feeding soybean milk residue on the growth performance, haematological and serum biochemistry of growing rabbits.

## Materials and Methods

The experiment was conducted at the Rabbitry unit of the Livestock Teaching and Research Farm, Joseph Sarwan Tarka University Makurdi Benue state. Makurdi is located at Latitude 7º 14' North and Longitude 8º 24' East and lies within the Southern Guinea Savannah Region of Nigeria. The annual temperature ranges from 22.43 to 33.41ºC. High temperature is experienced between late February and April. The annual rainfall is between 1270mm-1397mm (Abu, 2002) [2].

### Test ingredient

Soybean milk residue was sourced within Makurdi and its environs. The residue was sun-dried for 5-7 days and thereafter mixed with other feed ingredients to form a complete diet.

### Experimental animals Management

A total of twenty-five crossbreed rabbits aged between 6 - 7 weeks were used for the study. The rabbits were weighed at the beginning of the experiment and randomly distributed into five treatment groups of five rabbits per treatment. Each rabbit served as a replicate in a completely randomized design (CRD). Five experimental diets were formulated to contain soybean milk residue at 0%, 6%, 12%, 18%, and 24% respectively. The rabbits were housed in hutches with an iron frame and wire mesh placed in an open-sided house with dwarf walls. The hutches were partitioned into cages of 90 x 60 x 90 cm, occupied by one rabbit each. Feeders and water troughs were attached firmly to the wall of the cages. Feed and water were provided to the ad libitum. The daily weight gain was obtained by dividing the total weight gain by the number of days of the experiment. Feed conversion ratio was determined as the ratio of total feed intake to the total weight gain of the rabbits. The feeding trial lasted for 12 weeks.

### Haematological parameters

Blood samples from individual rabbits were collected into labeled Ethylene-diamine-tetra-acetic acid (EDTA) treated tubes for haematological analysis and the blood for serum biochemical evaluation was collected into separate tubes without anticoagulant. Evaluations were determined according to the method described by Bitto and Gemade, (2001) [8].

### Laboratory analysis

The Proximate and anti-nutritional composition of sun-dried soybean milk residue was determined according to the method described by AOAC, (2006) [5].

### Statistical analysis

All data obtained were subjected to one-way analysis of Variance (ANOVA) for completely randomized design (CRD) using Minitab statistical software, where significant differences occurred, and parameter means were separated using least significant difference (LSD).

**Table 1:** Ingredients composition of the experimental diets

| Ingredients | T1 | T2 | T3 | T4 | T5 |
|---|---|---|---|---|---|
| Maize | 32.50 | 32.00 | 27.00 | 22.50 | 18.50 |
| Maize offal | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| Full-fat Soybean | 38.00 | 33.50 | 32.00 | 30.00 | 27.20 |
| SBMR | 0.00 | 6.00 | 12.00 | 18.00 | 24.00 |
| BDG | 4.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| Rice offal | 17.00 | 14.50 | 14.50 | 14.50 | 15.00 |
| Palm oil | 2.00 | 2.50 | 3.00 | 3.50 | 3.80 |
| Bone meal | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 |
| Salt | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Lysine | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Methionine | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Vit/Min. Premix | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| **Calculated Nutrient Composition** | | | | | |
| CP | 18.60 | 18.03 | 17.48 | 17.35 | 17.32 |
| CF | 9.01 | 9.40 | 9.80 | 10.20 | 10.60 |
| Ca | 1.03 | 1.03 | 1.03 | 1.04 | 1.04 |
| P | 0.87 | 0.88 | 0.87 | 0.86 | 0.86 |
| ME (kcal/kg) | 2773.33 | 2755.00 | 2736.30 | 2718.00 | 2699.30 |

## Results and Discussion

The results of the proximate and anti-nutritional composition of soybean milk residue are shown in Table 2. The results indicated that soybean milk residue contains 96.685% dry matter (DM), 3.32% moisture, 24.06% crude protein (CP), 14.81% crude fiber (CF), 2.52% ether extracts (EE), 6.42% ash, 48.87% nitrogen-free extracts (NFE) and 2837.04 ME (kcal/kg). For the ant-nutritional composition; (0.68%) oxalate, (0.85g/100g) phytase, (2.14TUI/mg) trypsin, cyanide, and tannin were not detectable.

The crude protein content of 24.06% obtained in this study is higher than the value of 19.99% reported by Darunee and Wichai (2014) [9] but lower than 26.37% and 27.88% reported by Abdullahi *et al*., (2021) [1] and Sompong and Pirote, (2008) [30]. According to Wafar *et al*. (2017) [33], an ingredient is certified as an alternative protein source if its crude protein content is 18% or higher. The crude fiber content recorded in this study is higher than 5.61% and 12% reported by Darunee and Wichai (2014) [9] and O'Toole, (1999) [25] but lower than 20% reported by Odeyinka *et al*., (2007) [21]. The ether extracts recorded in this study are lower than the value of 4.98% and 5.54% reported by Sompong and Pirote, (2008) [30] and Maidala and Doma (2016) [16] respectively.

The ash content recorded in this study is lower than 9.8% reported by Odeyinka *et al*., (2007) [21].

The metabolizable energy value recorded in this study is an indication that soybean milk residue can be utilized as an

energy-feed ingredient in non-ruminant animals as observed by other authors (Abdullahi *et al*. 2021; Saleh *et al*. (2008) [1, 28]. The result of the anti-nutritional factors obtained in this study is within the acceptable value reported by Wafar *et al*., (2017) [33]. For rabbits raised under tropical conditions. The difference observed in nutrient composition could the attributed to variations in location, soybean varieties, and processing methods used.

**Table 2:** Proximate and anti-nutritional composition of soybean milk residue

| Parameters | Composition (%) | Anti-nutritional factor | Composition |
|---|---|---|---|
| Dry matter | 96.68 | Oxalate (%) | 0.68 |
| Moisture | 3.32 | Phytate (g/100g) | 0.85 |
| Crude protein (CP) | 24.06 | Trypsin (TUI/mg) | 2.14 |
| Ether extract (EE) | 2.52 | Cyanide | ND |
| Crude fiber (CF) | 14.81 | Trypsin (TUI/mg) | ND |
| NFE | 48.87 | | |
| ME (kcal/kg) | 2837.04 | | |

ND = Not detectable, TUI = trypsin inhibitor unit, NFE = Nitrogen free extract, ME = Metabolizable energy. The metabolizable energy was calculated using the formula of Pauzenga (1985).

Table 3 showed the result of the growth performance of rabbits fed soybean milk residue. A significant difference (P<0.05) was recorded on all the parameters measured. The final body weight values recorded in this study range between 1410.60 – 1619.28 g is higher than the value reported by Ojebiyi *et al*., (2013) [22] and Abdullah *et al*., (2021) [2] but lower than the value reported by Sudik *et al*., (2020) [31] when soybean milk residue was fed to rabbits. T5 recorded the highest body weight while T1 (control) recorded the lowest. The observed increase in final body weight observed in this study could be attributed to higher feed consumption and improved soybean milk residue utilization. The average daily weight values of between 10.42 – 12.48 recorded in this study are within the range reported by Attah *et al*., (2012) [6], Saleh *et al*., (2008) [28], and Abdullahi *et al*., (2021) [1]. The average daily feed intake range of 52.30 – 63.87 obtained in this study is higher than the value reported by Odeyinka *et al*., (2007) [21] and Emmanuel *et al* (2018) [10] but lower than the range recorded by Maidala and Dama, (2016) and Abdullahi *et al* (2021) [1]. The observed difference could be attributed to the breed, age, sex, nutrition, and study duration (Lei *et al*., 2004). Rabbits-fed soybean milk residue-based diets had a better feed conversion ratio than the control. The result of this study is in line with the report of Maidala and Dama, (2016) who observed a significant difference (P<0.05) in the feed conversion ratio when soybean milk residue was fed to rabbits.

**Table 3:** Growth performance of rabbits fed soybean milk residue

| Parameters | T1 | T2 | T3 | T4 | T5 | SEM |
|---|---|---|---|---|---|---|
| Initial body wt. (g) | 529.80 | 525.80 | 528.20 | 527.50 | 525.60 | $1.21^{ns}$ |
| Final body wt. (g) | $1410.60^{b}$ | $1474.40^{b}$ | $1540.40^{ab}$ | $1575.00^{ab}$ | $1619.28^{a}$ | 48.21* |
| Daily feed intake (g) | $52.30^{c}$ | $54.28^{bc}$ | $57.35^{ab}$ | $58.70^{ab}$ | $63.87^{a}$ | 1.73* |
| Daily weight gain | $10.42^{b}$ | $11.29^{ab}$ | $12.05^{ab}$ | $12.48^{a}$ | $13.02^{a}$ | 0.72* |
| Feed conversion ratio (g) | $5.02^{a}$ | $4.81^{ab}$ | $4.76^{ab}$ | $4.71^{ab}$ | $4.91^{a}$ | 0.28* |

a,b,c means within the same row with different superscripts significantly different (P<0.05)
SEM= standard error of the mean, T1 = 0% inclusion level of soybean milk residue, T2 = 6% inclusion level of soybean milk residue, T3 = 12% inclusion level of soybean milk residue, T4 = 18% inclusion level of soybean milk residue, T5 = 24% inclusion level of soybean milk residue

The results of heamatological parameters of growing rabbits fed diets containing soybean milk residue are presented in Table 3. A significant difference (P<0.05) was observed for packed cell volume (PCV), red blood cell (RBC), and hemoglobin concentration (Hb) among the treatment groups, while mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were not affected by the treatment diets. Packed cell volume (PVC) is involved in the transport of oxygen and nutrient absorption. PCV values obtained in this study were within the range reported by Onifade and Tewe, (1993) [23] for the normal physiological function of rabbits, indicating that soybean milk residue was better utilized across the treatment groups. This is in line with the report of Isaac *et al*. (2013) [15] who observed that normal PCV values are signs that rabbits are in good nutritional status. Red blood cells (RBC) ranged from 4.27 – 4.63 ($x10^{12}$/l) recorded in this study were within the values reported by Medirabbit (2011) [17]. White blood cells (WBC) play a vital role in fighting infections, protecting the body from attack by foreign organisms, and transporting antibodies as part of an immune response. The WBC value obtained in this study is within the normal range reported by Moore *et al*. (2015) [18] and RAR, (2009) [27]. The results showed that the experimental animals were healthy, because lower WBC below the normal range is an indication of allergic conditions, anaphylactic shock, and certain parasitism, thereby creating huge problems to the animal's immune system while high counts indicate the presence of infection, usually with bacteria. Haemoglobin concentration (Hb) value of 13.33 – 14.90 g/dl obtained in this study is in line with the value reported by PGCVS (1990). The normal range value of haemoglobin (Hb) indicates that the essential physiological link between haemoglobin and oxygen in the movement of gases (oxygen and carbon dioxide) to and fro the tissue has been maintained, according to Njidda *et al*. (2006) [19]. The mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) values obtained in this study were within the normal range for healthy rabbits. This is an indication that the experimental animals were not anaemic.

**Table 4:** Effect of soybean milk residue on heamatological parameters of growing rabbits

| Parameters | T1 | T2 | T3 | T4 | T5 | SEM |
|---|---|---|---|---|---|---|
| PCV (%) | 40.00$^{b}$ | 44.67$^{a}$ | 41.67$^{ab}$ | 41.67$^{ab}$ | 42.33$^{ab}$ | 0.53* |
| RBC (x10$^{12}$/l) | 4.27$^{b}$ | 4.63$^{a}$ | 4.40$^{ab}$ | 4.27$^{b}$ | 4.33$^{ab}$ | 0.05* |
| WBC (x10$^{9}$/l) | 6.67 | 6.68 | 6.77 | 6.43 | 6.70 | 0.08$^{ns}$ |
| HB (g/dl) | 13.33$^{b}$ | 14.90$^{a}$ | 14.20$^{ab}$ | 13.90$^{b}$ | 14.13$^{ab}$ | 0.17* |
| MCV (fl) | 93.73 | 96.50 | 94.83 | 97.73 | 96.43 | 0.85$^{ns}$ |
| MCH (pg) | 27.90 | 32.17 | 31.77 | 32.17 | 32.62 | 0.81 |
| MCHC (g/dl) | 33.30 | 33.33 | 33.30 | 33.33 | 33.37 | 0.02$^{ns}$ |

a,b,c means within the same row with different superscripts significantly different (P<0.05)
SEM= standard error of the mean, T1 = 0% inclusion level of soybean milk residue, T2 = 6% inclusion level of soybean milk residue, T3 = 12% inclusion level of soybean milk residue, T4 = 18% inclusion level of soybean milk residue, T5 = 24% inclusion level of soybean milk residue.

Serum biochemistry of growing rabbits fed diets containing soybean milk residue is presented in Table 5. A significant difference (P<0.05) was recorded for serum albumin and cholesterol while serum total protein, globulin, glucose, and urea were not affected by the inclusion of soybean milk residue in the diets. The result of total protein fell within the normal value reported by Talis De *et al*. (2005) [32]. This is an indication that the experimental diets contained adequate nutrients for the healthy growth and development of rabbits. The albumin value obtained in this study were comparable to the normal range reported by Medirabbit (2011) [17], therefore suggesting the proper functioning of the liver and heart of the experimental animals. The serum globulin value recorded in this study were within the normal range reported by Burke, (1994) [7]. The result showed that the experimental animals had good resistance to disease and a high level of immunity. The cholesterol value obtained in this study fell within the range reported by Burke, (1994) [7]. Rabbits fed T1 (control) had higher cholesterol values than the rabbits fed soybean milk residue-based diets. The decrease in the serum cholesterol value of experimental animals fed the experimental diets may indicate a general decline in lipid mobilization, and it may also indicate that the soybean milk residue diet was effective at lowering serum cholesterol and assisting in the reduction and deposition of cholesterol in the muscle, thereby promoting the production of lean meat. The results further confirmed the nutritive quality of soybean milk residue in enhancing the health status of rabbits. The urea value obtained in this study were within the range reported by Medirbabbit (2011). Rabbits fed T1 recorded the highest level of urea, this could be attributed to an increase in the activities of uric enzymes ornithine carbonoyle transferase and arginase. According to Esonu *et al*. (2001) [12] and Etim and Oguike (2011) [13], the amount of urea is dependent on the quality of protein in the body; a high level of urea indicates low protein quality, whereas a low level indicates high protein quality. This result is in line with the report of Oladunjoye *et al*. (2014) [24] who observed that an amino acid imbalance would result in an increase in blood urea concentration. This could be an indication that the diet is high in nutrients and has a better balance of amino acids (Soetan *et al*., 2013) [29].

**Table 5:** Effect of soybean milk residue on serum biochemical indices of growing rabbits

| Parameters | T1 | T2 | T3 | T4 | T5 | SEM |
|---|---|---|---|---|---|---|
| Total protein (g/dl) | 5.27 | 5.60 | 5.30 | 5.27 | 5.37 | 0.09$^{ns}$ |
| Albumin (g/dl) | 3.03$^{ab}$ | 3.50$^{a}$ | 3.00$^{ab}$ | 3.20$^{ab}$ | 2.93$^{b}$ | 0.08* |
| Globulin (g/dl) | 2.17 | 2.10 | 2.30 | 2.07 | 2.53 | 0.14$^{ns}$ |
| Glucose (mg/dl) | 95.10 | 86.40 | 91.70 | 95.97 | 94.90 | 2.23$^{ns}$ |
| Cholesterol (mg/dl) | 70.60$^{a}$ | 48.37$^{b}$ | 55.57$^{ab}$ | 44.60$^{b}$ | 48.00$^{b}$ | 3.10* |
| Urea (mg/dl) | 42.50 | 33.20 | 35.20 | 36.60 | 31.07 | 1.73$^{ns}$ |

a,b,c means within the same row with different superscripts significantly different (P<0.05)
SEM= standard error of the mean, T1 = 0% inclusion level of soybean milk residue, T2 = 6% inclusion level of soybean milk residue, T3 = 12% inclusion level of soybean milk residue, T4 = 18% inclusion level of soybean milk residue, T5 = 24% inclusion level of soybean milk residue

## Conclusion

The findings showed that soybean milk residue can be fed to rabbits at 24% level of inclusion without any detrimental effect on the performance, haematology, and serum biochemistry of rabbits.

## References


1. Abdullahi U, Yusuf HB, Wafar RJ, Mijinyawa A, Abubakar A, Shuaibu US, *et al*. Growth performance, carcass characteristics and internal organ weights of weaner rabbits fed replacement levels of sun-dried soya bean milk residue. Nig. J Anim. Prod. 2021; 48(3):93-99. doi.org/10.51791/njap.v48i3.2948
2. Abu IB. Agric project report. Department of Soil Science University of Agriculture Makurdi-Nigeria, 2002, 22-26.
3. Adesehinwa AOK, Ogunmodede BK. Performance and serum metabolites of growing pigs fed diets containing 'Dusa' and cashew nut testa as protein sources. Indian Journal of Animal Science. 2004; 74(1):3-6.
4. Akinmutimi AH Nutritive value of Raw and Processed Jack Fruit Seed (*Artrocarpusheterophillus*), Chemical Analysis. Nigerian Agricultural Journal. 2006; 4:266-271
5. AOAC. Official Methods of Analysis. 18th Edition, Association of Official Analytical Chemists, Gaithersburgs, MD, 2006.
6. Attah S, Shaahu DT, Tsewua AS, Agbidye T. Effect of graded levels of Soybean Milk Residue in diets on Performance and Carcass characteristics of rabbits. Proceedings of the 15th Association of Animal

Production Society, Thammasat University, Thailand. 2012; 2:3710-3714.
7. Burke J. Clinical care and medicine of pet rabbit, In: Proceedings of the Michigan Veterinary Conference, 1994, 49-77.
8. Bitto II, Gemade M. Preliminary investigations on the effect of Pawpaw peel meal on growth, visceral organ and endocrine gland weights, testicular morphometry and the hematology of male rabbits, Global Journal of Pure and Applied Sciences. 2001; 7(4):611-625.
9. Darunee S, Wichai S. Utilization of Soybean milk residue as additive of Para grass silage. Thammasat International Journal of Science and Technology. 2014; 19(4):1-6.
10. Emmanuel SS, Carew SN, Attah S. Effect of feeding graded levels of soymilk residue on growth and meat yield of rabbits. 7th ASAN-NIAS Joint Annual Meeting (ASAN-NIAS JAM), Ilorin, Kwara State Nigeria. Editors: Atteh, J. O., Belewu, M. A., Fayeye, T. R., Okukpe, K. M., Alli, O. I. and Adeyemi, K. D, 2018, 308-310.
11. Emmanuel SS, Odunlade TA, Uza O. Nutritive value of soybean milk residue on digestibility and visceral organ of growing rabbits. American Research Journal of Humanities Social Science (ARJHSS). 2021; 04(05):09-14.
12. Esonu BO, Emenalom OO, Udedibie ABI, Berbert U, Ekpor CF, Okoli EC, *et al*. Performance and chemistry of weaner pigs fed raw mucuna meal (Velvet bean) meal. Tropical Animal Production Investment. 2001; 4:49-54.
13. Etim NN, Oguike MA. Haematology and serum biochemistry of rabbit does fed Aspilia Africana. Nigerian Journal of Agriculture, Food and Environment. 2011; 7(4):121-127.
14. Fakolade PO, Adewole YA, Osunkeye OJ. Heamatology, serum analysis, cholesterol status and physic-chemical evaluation of rabbit fed Africa sunflower leaf meal in their diet. 7th ASAN-NIAS Joint annual Meeting, Ilorin 2018, Editors.Atteh, J. O., Belewu, M. A., Fayeye, T. R., Okukpe, K. M., Alli, O. I. and Adeyemi, K. D, 2018, 308-310.
15. Isaac LJ, Abah G, Akpan B, Ekaette IU. Haematological properties of different breeds and sexes of rabbits. Proceedings of 18th Annual Conference of the Animal Science of Nigeria (ASAN), 2013, 24-27.
16. Maidala A, Doma UD. Growth response and carcass characteristics of rabbits fed soyabean curd residue as replacement for full-fat soya beans. ATBU, Journal of Science, Technology & Education. 2016; 4(1):156-162.
17. Medirabbit. Complete blood count and biochemical reference values in rabbits, 2011. www.medirabbit.com.
18. Moore DM, Zimmerman K, Smith SA. Haematology of laboratory rabbits. Heamatological Assessment in Pet Rabbits, blood sample collection, and blood cell identification. Vet Clin Extot Anim. 2015; 18:9-19.
19. Njidda AA, Igwebuike JU, Isidahomen CE. Haematological parameters and carcass characteristics of weaning rabbits fed graded levels of molasses. Global Journal of Agricultral Science. 2006; 5(7):167-172.
20. Nistor E, Beeampidis VA, Pentea M, Tozer J, Prundeamu H. Nutrient Content of Rabbit meat as compared to Chicken, Beef and Pork meat. Journal of Animal Production Advance. 2013; 3(4):172-176.
21. Odeyinka SM, Olosunde AS, Oyedele OJ. Utilization of Soybean milk residue, Cowpea testa and Corn starch residue by weaner rabbits. Livestock Research for Rural Development, 2007, 19(9).
22. Ojebiyi OO, Oladunjoye IO, Aboderin OJ, Okelade AA. Synergetic Effect of Cassava sievate/Soybean milk residue mixtures as replacement for Maize in Growing rabbit's diet. Journal of Natural Science Research. 2013; 3(7):129-135.
23. Onifade AA, Tewe OO. Alternative tropical energy feed performance in rabbit diets: Growth performance, diets digestibility and blood composition. World Rabbits Sci. 1993; 1:17-24.
24. Oladunjoye IO, Akinlade M, Lawal Z. Performance, digestibility, carcass, and blood profile of grower rabbits fed baobab (*Adansonia digitata)* pulp and seed meal. Indian Journal of Fundamental and Applied Life Sciences. 2014; 42(2):2231-2245.
25. O'Toole DK. Characteristics and use of okara, the soybean residue from soymilk production. Journal of Agricultural and Food Chemistry. 1999; 47(2):363-371.
26. PGCVS. Post graduate Committee in Veterinary Science. Rabbits and rodents laboratory. Animal Science Proceedings 142 Sydney, Australia, 1990.
27. Research Animal Resource (RAR). Reference values for laboratory animals: Normal haemotological values. RAR websites, RAR, University of Minnesota, 2009. http://www.ahe.umn.edu.rar.refva lues.htm
28. Saleh I, Bawa GS, Hudu MI, Ibrahim UM, Abubakar S. Soybean Curd Residue as an Alternative, Non-conventional Protein Source for Improving Rabbit Performance. Nigerian Journal of Agricultural Extension. 2008; 19(3):42-49.
29. Soetan KO, Akinrinde AS, Ajibade TO. Preliminary studies on the haematological parameters of cockerels fed raw and processed guinea corn (Sorghum bicolor). Proceedings of 38th Annual Conference of Nigerian Society for Animal Production (ASAN), 2013, 49-52.
30. Sompong S, Pirote S. Nutritive composition of soybean by-products and nutritive digestibility of soybean pod husk. Maejo. International Journal of Science and Technology. 2008; 2(03):568-576.
31. Sudik SD, Ajiji I, Bagudu IA, Maidala A, Lawan A. Effect of feeding soybean curd residue on performance of male grower rabbits. Greener Journal of Agricultural Sciences. 2020; 10(2):114-119.
32. Talis De OS, Luiz CK, Leonardo J, Joao B, Auren BS, Cleverson S. Reference values for Chinchilla (*chinchilla laniger*) blood cells and serum biochemical parameters. Cienc. Rural. 2005; 35(3):1-8.
33. Wafar RJ, Yakubu B, Lalabe BC. Effect of feeding raw kapok (ceiba pentandra) seed meal on the growth performance, nutrient digestibility, carcass, and organ weights of weaner rabbits Asian. J Agaric Res. 2017; 5(3):1-8.
34. Wafar RJ, Yakubu B, Yusuf HB, Antyev M. Effect of Feeding Raw and Differently Processed Kapok (*Ceiba pentandra*) Seed Meal on the Growth Performance and Carcass Characteristics of Weaner Rabbits. Nigerian Journal of Animal Science. 2018; 20(2):258-270.